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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/605,319	09/22/2003	David G. GRIER	12962.0008.DVUS01	2318

7590 07/17/2006

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EXAMINER	
LAVARIAS, ARNEL C	
ART UNIT	**PAPER NUMBER**
2872	

DATE MAILED: 07/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/605,319	GRIER ET AL.	
	Examiner	Art Unit	
	Arnel C. Lavarias	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 May 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/18/06 has been entered.

Drawings

2. The replacement drawings were received on 5/18/06. These drawings are acceptable.

Response to Amendment

3. The amendments to the specification of the disclosure in the submission dated 5/18/06 are acknowledged and accepted. In view of these amendments, the objections to the specification in Section 7 of the Office Action dated 11/21/05 are respectfully withdrawn.

4. The amendments to Claims 1, 12 in the submission dated 5/18/06 are acknowledged and accepted.

Response to Arguments

5. The Applicants again argue that the specification of the disclosure does provide antecedent bases for the subject matter recited in Claims 11 and 22. The Examiner again respectfully disagrees. The Examiner again refers Applicants to the remarks in Section 3 of the Office Action dated 11/21/05, as well as the remarks in Section 7 of the Office Action dated 3/15/05. Further, though Applicants are correct in stating that the claimed feature of the DOE being positioned in the back focal plane of the focusing element are part of the original specification since they are recited in the original claims, this feature is not recited in the original specification, and thus the specification does not provide adequate antecedent basis for this claimed feature. In addition, with respect to newly added Figure 3B, it is noted that Figure 3B specifically discloses the DOE being located at the plane containing point B, which is located at the back aperture of the objective lens. The back aperture of an objective lens is not the same feature as the back focal plane of the objective lens.

6. The Applicants' arguments filed 5/18/06 have been fully considered but they are not persuasive.

7. The Applicants argue that, with respect to newly amended Claims 1 and 12, as well as Claims 2-11, 13-22 which depend on Claims 1 and 12, the combined teachings of Neal and Schütze fail to teach or reasonably suggest diffraction means for simultaneously creating a plurality of separate laser beams, forming a plurality of separate optical traps capable of being moved in different directions, and changing the position of at least one of the plurality of particles in a predetermined direction, and that no motivation exists to

combine the teachings of Neal and Schütze. The Examiner respectfully disagrees. The Examiner again refers Applicants to remarks in Section 5 of the Office Action dated 11/21/05. In addition, it is noted that the combined teachings of Neal and Schütze (See specifically the Abstract; col. 7, lines 19-27 of Schütze) further disclose that the trapped particles may be moved separately in a different direction independent of the movement of other trapped particles.

8. Claims 1-22 are rejected as follows.

Specification

9. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required:

Claims 11 and 22- the drawings and the specification of the disclosure fail to show or recite the diffractive optical element being positioned in the back focal plane of the focusing element.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1-2, 4, 6-9, 12-13, 15, and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal (U.S. Patent No. 5939716), of record, in view of Schütze (U.S. Patent No. 5689109), of record.

Neal discloses a method for manipulating a particle by forming and moving a plurality laser beams forming an optical trap or cage (See for example Figure 4, 6), the method comprising providing at least one laser beam from at least one source (See 26 in Figure 4); applying the at least one laser beam to diffraction means for simultaneously creating a plurality of separate laser beams from each of the at least one laser beam (See 18 in Figure 4); establishing an optical gradient for each of the plurality of separate laser beams to form at least one optical trap or cage for trapping and/or moving the particle (See col. 5, line 50-col. 6, line 36); and performing a manufacturing process which changes the position of the particle (See col. 8, lines 7-40). Neal also similarly discloses the manufacturing process being, for example, manipulating the structure of biological materials (See col. 8, lines 7-40); the step of establishing an optical gradient comprising the step of focusing at least one of the laser beams (See 24 in Figure 4); the step of moving the particle comprising the step of dynamically changing locations of the optical trap or cage (See col. 2, line 49-col. 3, line 8); moving the particle by translating at least one of laterally and axially the optical trap relative to an optical axis (See col. 2, line 49-col. 3, line 8); converging selected ones of the laser beams and forming the optical trap at spatial locations either in the focal plane or out of a focal plane of an objective lens (See 18, 24, 28 in Figure 4); moving the particle by moving a sample stage relative to a specimen comprising the trapped particles (See col. 2, line 49-col. 3, line 8); and at least

one focusing element (See for example 36, 24 in Figure 4; Objective with Z-drive in Figure 6). Neal lacks the particle being a plurality of particles and the optical trap being a plurality of optical traps, and the traps capable of being moved in different directions such that the position of at least one of the plurality of particles changes in a predetermined direction. However, it is well known and conventional in the art to perform such particle manipulations utilizing optical traps wherein a plurality of particles is provided and wherein a plurality of optical traps is utilized to perform the manipulations. For example, Schütze teaches an apparatus and method for manipulating small biological particles utilizing one or more optical trapping beams (See Abstract; Figure). In particular, Schütze teaches one particular embodiment wherein each of two or more infrared laser beams (See 4 in Figure; col. 4, line 55-col. 5, line 11) create an optical trap to trap and manipulate multiple individual biological particles (See col. 6, line 66-col. 7, line 67). The particles may be manipulated individually by controlling individual traps such that the movement of individual trapped particles is independent of the movement of other trapped particles, or the particles may be manipulated as a group, such as by controlling the individual traps together or moving the sample stage (See Abstract; col. 6, line 66-col. 7, line 43). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the method of Neal manipulate a plurality of particles by forming and moving a plurality laser beams forming a plurality of optical traps or cages (i.e. utilizing 3 or more laser beams per particle to create each optical cage for each particle), and the traps capable of being moved in different directions such that the position of at least one of the plurality of particles

changes in a predetermined direction, as taught by Schütze, for the purpose of providing simultaneous, and possibly independent, manipulation of the plurality of particles, thus reducing process time (i.e. time multiplexing, moving 2 or more particles simultaneously at a time vs. moving a single particle at a time).

12. Claims 3 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Schütze as applied to Claims 1 and 12 above, and further in view of Long (U.S. Patent No. 5986781), of record.

Neal in view of Schütze discloses the invention as set forth above in Claims 1 and 12, except for the diffraction means being a time-addressable phase-shifting medium. However, as is known in the art, diffractive optical elements may be implemented utilizing liquid crystal spatial light modulators (SLM) or displays. For example, Long et al. teaches a liquid crystal display (See for example 68 in Figure 1) which dynamically received computer-generated data and displays such data (See entire document, especially Abstract). Each data corresponds to an optical characteristic, such as an amplitude or phase, to be applied to the incident light. Further, the SLM may be addressed in real time. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the diffraction means be a time-addressable phase-shifting medium, as taught by Long, in the method for manipulating a plurality of particles of Neal in view of Schütze, to provide continuous, real-time adjustments to the optical characteristics of the diffraction optical element.

13. Claims 5 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Schütze as applied to Claims 1 and 12 above, and further in view of Sasaki et

al. (K. Sasaki, M. Koshioka, H. Misawa, N. Kitamura, H. Masuhara, 'Pattern formation and flow control of fine particles by laser-scanning micromanipulation', Opt. Lett., vol. 16, no. 19, October 1, 1991, pp. 1463-1465.), of record.

Neal in view of Schütze discloses the invention as set forth above in Claims 1 and 12, except for the step of applying to the plurality of laser beams a transfer optical element which interacts with the laser beams to transfer an optical point of an optical train to another optical point location. However, the use of such transfer optical elements, such as relay optics and telescope optics are known in the art of microscopy. For example, Sasaki et al. teaches a laser scanning micromanipulation microscope apparatus based on optical trapping technique (See for example Figure 1), wherein a telescope or relay optical system (See L1, L2 in Figure 1) is utilized in the beam path. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the method of Neal in view of Schütze include the step of applying to the plurality of laser beams a transfer optical element which interacts with the laser beams to transfer an optical point of an optical train to another optical point location, as taught by Sasaki et al., for the purpose of providing beam diameter matching and image relaying capabilities.

14. Claims 10 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Schütze as applied to Claims 1 and 12 above, and further in view of Sasaki et al.

Neal in view of Schütze discloses the invention as set forth above in Claims 1 and 12, except wherein the performing the manufacturing process comprises the step of moving

the plurality of particles by moving the plurality of laser beams and associated ones of the optical traps by action of a mirror disposed at a point conjugate to a back aperture of a focusing element. However, as is well known, the use and optical placement of scanning mirrors, particularly when used in conjunction with telescopic relay lenses and objective lenses in a microscope system, are known in the art. For example, as stated above, Sasaki et al. teaches a laser scanning micromanipulation microscope apparatus based on optical trapping technique (See for example Figure 1), wherein a telescope or relay optical system (See L1, L2 in Figure 1) is utilized in the beam path. Further, Sasaki et al. teaches the use of one or more scanning (galvano) mirrors to provide beam scanning and hence optical trap movement. The scanning mirror (See in particular the second galvano mirror in the beam path in Figure 1), the telescopic relay lenses (See L1, L2 in Figure 1), and the objective (See OL in Figure 1) are configured in such a way that the scanning mirror is disposed at a point conjugate to a back aperture of the objective. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the manufacturing process step of the method of Neal in view of Schütze further include the step of moving the plurality of particles by moving the plurality of laser beams and associated ones of the optical traps by action of a mirror disposed at a point conjugate to a back aperture of a focusing element, as taught by Sasaki et al., to impart a slight driving force to the trapped particles, thus allowing for easier movement and manipulation of the particles.

15. Claims 11 and 22, as best understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Neal in view of Schütze.

Neal in view of Schütze discloses the invention as set forth above in Claims 1 and 12, except for the diffractive optical element specifically being positioned in the back focal plane of the focusing element. However, it is noted that the diffractive optical element may be located or placed anywhere in front of/prior to the focusing element, including a location at the back focal plane of the focusing element, so long as the diffractive optical element provides the necessary beam splitting function to the incident optical beam, while still allowing for adjustment of the locations of the optical traps (See 12 in Figure 4 of Neal) in the focal plane (See 28 in Figure 4 of Neal) of the focusing lens (See 24 in Figure 4 of Neal). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the diffractive optical element be positioned, for example, in the back focal plane of the focusing element, to reduce the size of the diffractive optical element required for beam splitting while providing additional separation between the optical traps in the focal plane of the optical traps.

Conclusion

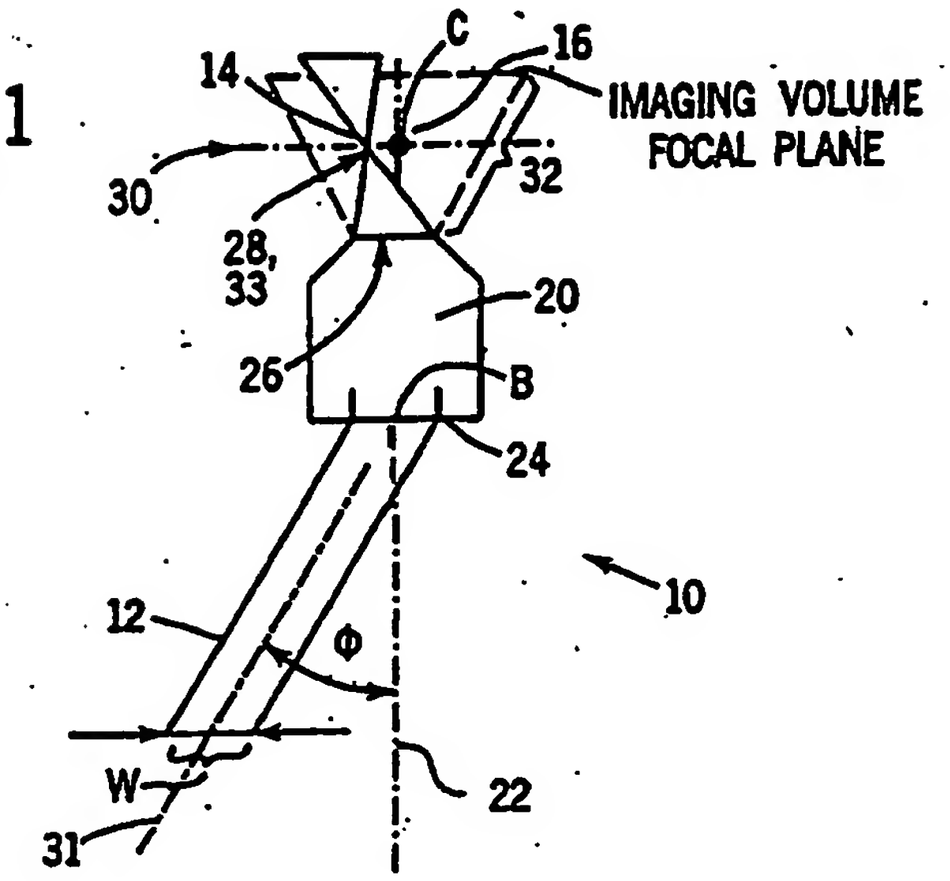
16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arnel C. Lavarias whose telephone number is 571-272-2315. The examiner can normally be reached on M-F 9:30 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Arnel C. Lavarias
Primary Examiner
Group Art Unit 2872
7/10/06

FIG. 1
PRIOR ART



Drawing Change Approved
AM
7/7/06

FIG. 2
PRIOR ART

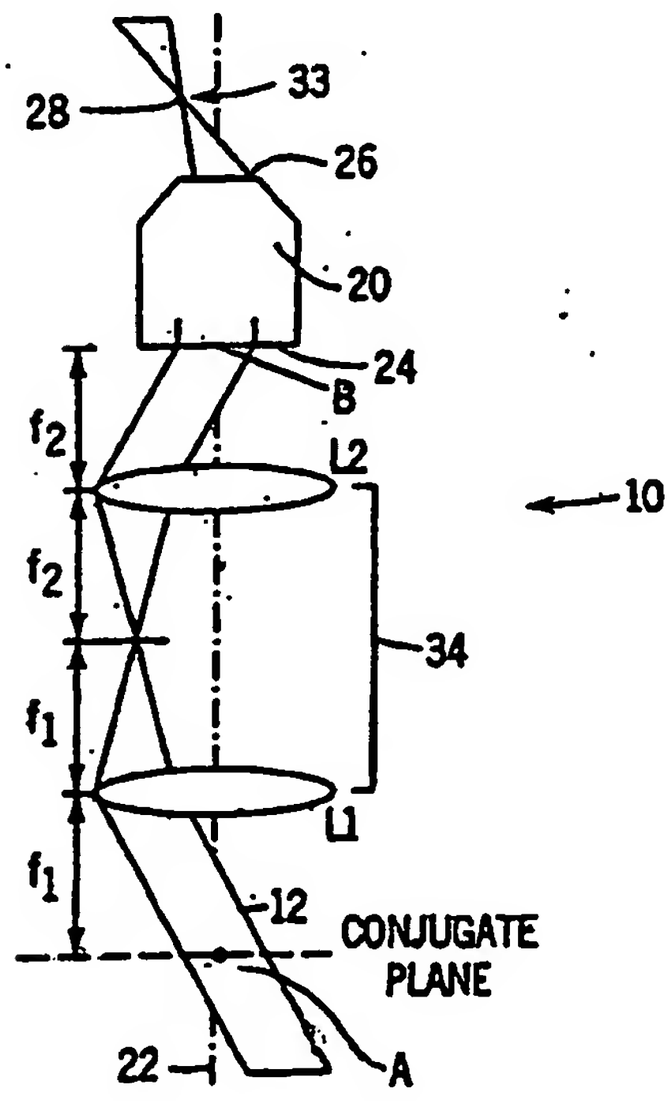
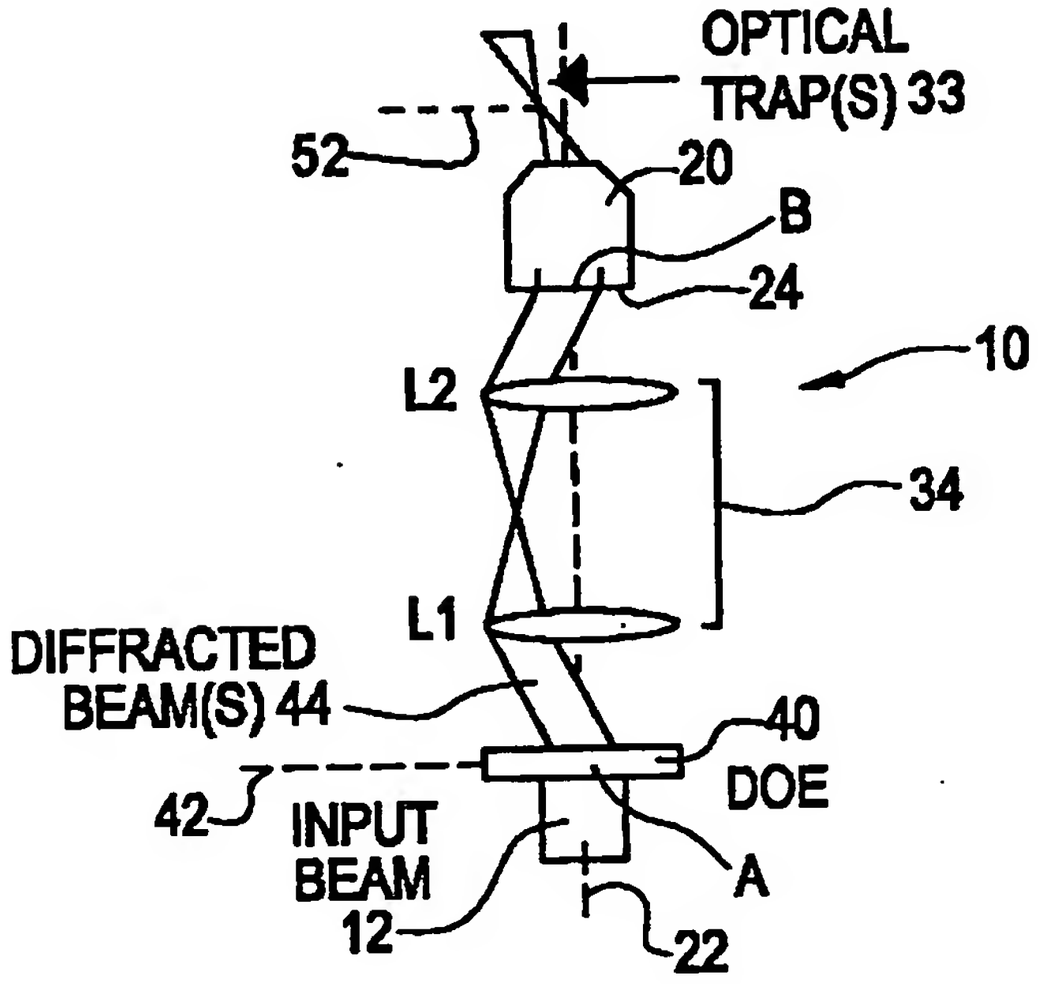


FIG. 3A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B
24
10
L2
34
L1
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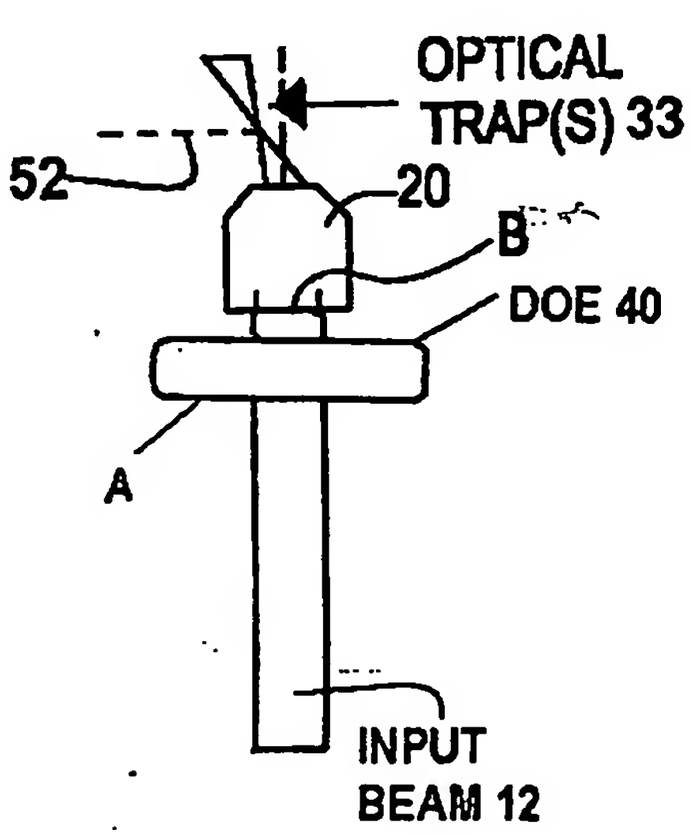
INPUT
BEAM
12
A
22

FIG. 3B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INPUT
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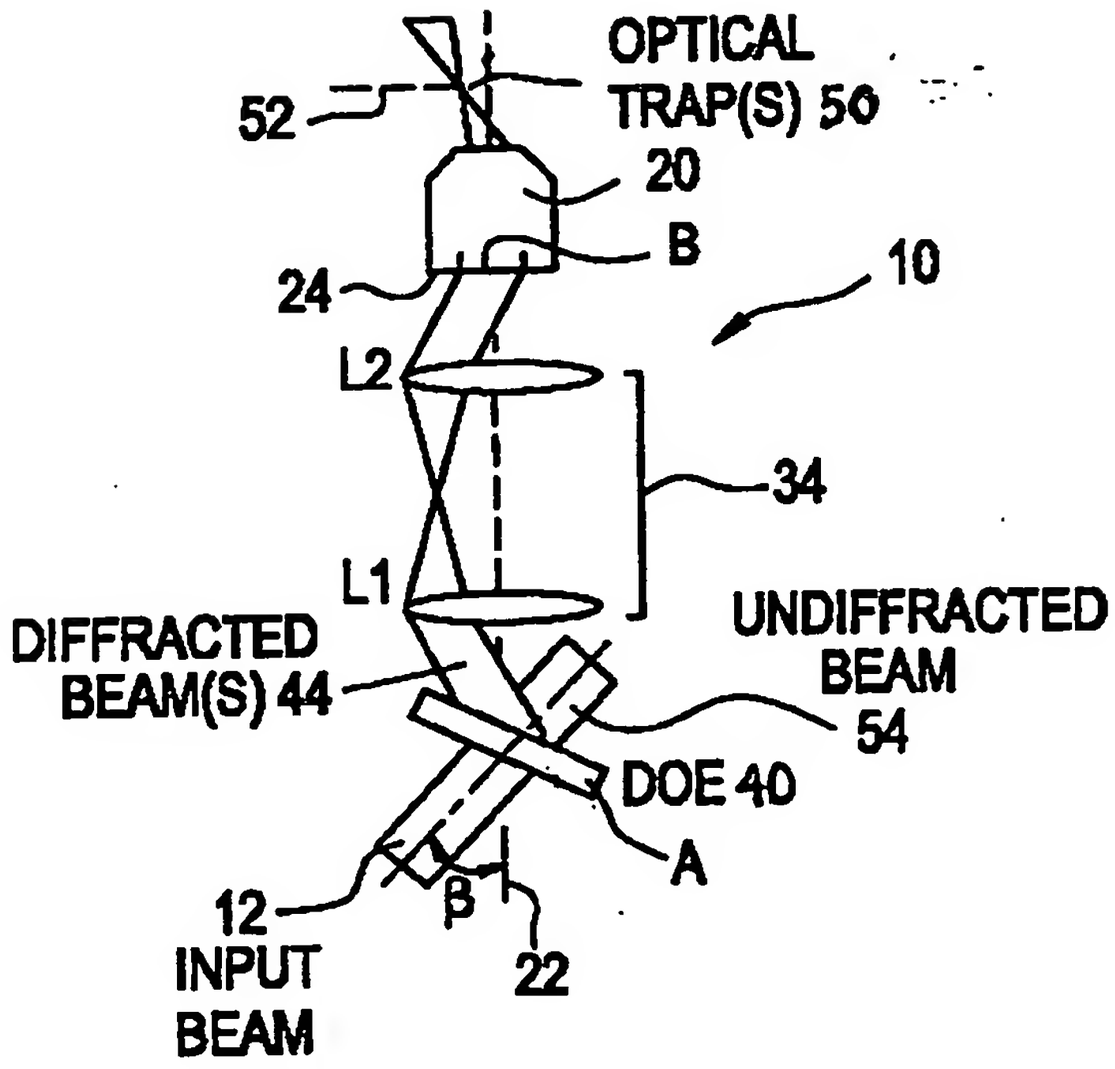
FIG. 4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54
DOE 40
A
12
INPUT
BEAM
β
22